

AMENDMENTS IN THE CLAIMS:

1. (Currently Amended) A scribe line forming apparatus comprising:

a vertical crack forming member that has a blade at a tip thereof and is used for forming a vertical crack to be an origination point of a scribe line by pressing the blade against a surface of a brittle substrate with pressure;

an impact force applying means for applying ~~an~~ a single abrupt impact force to the vertical crack forming member in order to generate the vertical crack having a predetermined depth at a desired position in the brittle substrate;

a heating means for forming an area having a temperature lower than a softening point of the brittle substrate;

a cooling means for cooling the brittle substrate;

an arrangement movement means for arranging the heating means, the vertical crack forming member, the impact force applying means, and the cooling means to be positioned so as to move relative to the brittle substrate at predetermined intervals along a planned scribe line that is prearranged on the surface of the brittle substrate; and

a control unit that controls driving of the impact force applying means.

2. (Original) The scribe line forming apparatus according to Claim 1, wherein

the control unit controls driving of the vertical crack forming member and the arrangement movement means so that the blade moves while being kept in contact with the surface of the brittle substrate by a load which does not allow the blade to damage the surface of the brittle substrate, and when the blade is positioned in the vicinity of an edge of the brittle substrate and in the vicinity of a passing point at which the blade passes a previously-formed scribe line, the control unit controls the driving of the impact force applying means so as to generate the vertical crack having the predetermined depth in the brittle substrate.

3. (Withdrawn) The scribe line forming apparatus according to Claim 1, wherein

the heating means includes a servo mechanism that detects a change in a height of the surface of the brittle substrate from up-and-down movements of the vertical crack forming member moving on the brittle substrate and adjusts a focal point of a laser beam irradiated from a laser beam oscillator according to a result of the detection.

4. (Withdrawn) The scribe line forming apparatus according to Claim 1, wherein the cooling means is arranged by the arrangement movement means so as to move up and down in conjunction with up-and-down movements of the vertical crack forming member that moves on the brittle substrate.

5. (Original) The scribe line forming apparatus according to Claim 1, wherein the arrangement movement means either arranges the vertical crack forming member, and the heating means, and the cooling means to be positioned in the stated order from a fore side of the planned scribe line, or arrange the heating means, the vertical crack forming member, and the cooling means to be positioned in the stated order from the fore side of the planned scribe line.

6. (Withdrawn) The scribe line forming apparatus according to Claim 1, wherein the arrangement movement means arranges the vertical crack forming member, the heating means, and the cooling means so as to be able to change positions relative to one another.

7. (Withdrawn) The scribe line forming apparatus according to Claim 1, wherein the cooling means includes a servo mechanism that adjusts a height at which the cooling means is positioned.

8. (Withdrawn) The scribe line forming apparatus according to Claim 1, wherein the vertical crack forming member is a glass cutter that includes a wheel tip serving as the blade and rollably supports the wheel tip.

9. (Withdrawn) The scribe line forming apparatus according to Claim 1, wherein the heating means is a laser beam oscillator that irradiates a predetermined laser beam.
10. (Withdrawn) A scribe line forming apparatus according to Claim 1, wherein the cooling means is a cooling nozzle from which a cooling medium is released.
11. (Withdrawn) The scribe line forming apparatus of Claim 1, wherein the impact force applying means is an armature that generates movement inertia for pressing the blade against the surface of the brittle substrate by turning on or off electricity supplied to a solenoid coil.
12. (Withdrawn) The scribe line forming apparatus according to Claim 1, further comprising;
one of a laser displacement gauge and a contact displacement gauge for detecting a change in a height of the surface of the brittle substrate.
13. (Withdrawn) The scribe line forming apparatus according to Claim 1, wherein the brittle substrate is one of a glass substrate for a liquid crystal display device, a glass substrate for a plasma display panel, and a glass substrate for an organic EL display panel.
14. (Currently Amended) A scribe line forming method comprising the steps of:
while making a vertical crack forming member having a blade at a tip thereof move on a brittle substrate, generating a vertical crack having a predetermined depth at a desired position on a brittle substrate with an impact force applying means that applies an a single abrupt impact force to the blade;
forming a scribe line by forming, with the vertical crack, an irradiation area that has a temperature lower than a softening point of the brittle substrate along a planned scribe line arranged on the brittle substrate, and forming a cooling area in rear of the irradiation area.

15. (Original) The scribe line forming method according to Claim 14, wherein the generating step of generating the vertical crack having the predetermined depth at the desired position on the brittle substrate by the impact force applying means is performed when the blade is positioned in the vicinity of an edge of the brittle substrate and in the vicinity of an intersection position at which the blade intersects a previously-formed scribe line.

16. (Previously Presented) The scribe line forming method according to claim 14, wherein the vertical crack is formed at a position slightly inside from an edge of the substrate.

17. (New) The scribe line forming apparatus according to claim 1, wherein the impact force applying means comprises a spring adjacent to the blade of the vertical crack forming member that applies a downward force, and a solenoid coil that generates a lifting electromagnetic force to counteract the spring force, wherein when a voltage applied to the solenoid coil is removed, the electromagnetic force of the solenoid ceases and the spring force causes an abrupt impact that drives the blade against the substrate to generate the vertical crack.

18. (New) The scribe line forming method according to claim 14, wherein the generating step of generating the vertical crack having the predetermined depth at the desired position on the brittle substrate by the impact force applying means comprises:

applying a downward spring force to a spring adjacent the blade of the vertical crack forming member and applying a lifting electromagnetic force to a solenoid coil to counteract the spring force, and

removing a voltage applied to the solenoid coil to cease the counteracting electromagnetic force of the solenoid such that the spring force causes an abrupt impact that drives the blade against the substrate to generate the vertical crack.